RESEARCH in Progress

Forest Products Laboratory

Protection and Remediation of In-Service Timber Bridges with Field-Applied Preservative Treatments (Phase I)

The Federal Highway Administration is responsible for designing, constructing, preserving, and maintaining hundreds of thousands of bridges in the United States. Timber bridges provide rapid, cost-effective, and durable bridge solutions. Over time, timber bridges, like bridges made of other materials, require inspection and maintenance. Routine and relatively inexpensive maintenance can often increase the life of the bridge.

Inspections may de-rate the load capacity of a given bridge or even subject it to closure. As an example, in 2018 and 2019, the governor of Mississippi ordered the closure of up to 512 local bridges because of federal safety standards; this impacted businesses due to the weight limits imposed on traffic. Many of these bridges are on county or secondary roads, where traffic weight can be heavy (such as log and farm trucks) even though volume is low). In Mississippi, 444 timber bridges are listed as in need of repair.

Timber is among the oldest building materials for bridges. With proper design, construction, and maintenance practices, timber bridges can offer suitable durability and economics comparable or superior to any other bridge material. Wood is a renewable material, has high strength-to-weight ratio, is durable and fire resistant, can be easily processed, and blends esthetically into the natural environment in rural and town areas. Timber bridges can be replaced quickly, thereby minimizing the time that a given road is out of service for repair. Wood is often capable of supporting short-term overloads without adverse effects, can resist decay with appropriate design, and can last for extended periods (on the order of 50 years or more).

Figure 1. Below-grade photograph of a stringer-type timber bridge on wood piling. The smaller diameter pilings on the right are remnants from a previous (lower capacity) timber bridge. The existing, higher capacity, bridge was installed over the same site as one located there previously.

Background

Despite several advantages, wood is not always the primary choice for engineers when building bridges. Lack of product knowledge and capacity is a barrier to adoption. Lack of consolidated instructional guides and performance data are perhaps additional market hurdles. In some cases, engineers (erroneously) may underestimate timber bridge life (at 20–30 years rather than 50+ years), which further limits adoption.

Objective

The aim of this study is to provide information about wood properties relevant to bridges design

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Figure 2. Timber bridge stringer in need of repair or replacement at its end that is sitting on a pile cap.

Figure 3. Timber bridge with upgraded capacity. The middle pile and pile cap are original. The left and right piles and caps were added later as a means of upgrading bridge capacity.

(mechanical and durability properties) and remediation and inspection techniques to extend timber bridge life expectancy. Another goal of this work is to increase awareness for engineers and specifiers with respect to the positive attributes (cost, sustainability, durability, and minimal time out of service) of timber bridges.

Approach

For this work, timber bridge construction and durability literature will be reviewed and summarized. Webinar-type information will be provided as a means of disseminating existing information to a wider audience. The project will examine aspects of enhancing durability through sound design and construction and remediating timber bridges in situ as a means of extending service life.

Expected Outcomes

This project is expected to consolidate and disseminate information on bridge design, inspection, preservation, and remediation technology. This information is expected to enhance and improve adoption of new timber bridges and extend the service life of those currently in use.

Timeline

This project will run from July 2019 through June 2021. The first part of the project (fall 2019) involving a review and summary of existing literature regarding bridge design and remediation is near completion. During 2020, webinar content will be developed and delivered. Additional technical reports and manuscripts will be developed throughout.

Cooperators

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References

Jackson, C.A. 2018. More than 500 Mississippi bridges remain closed. Available at https://www.wlbt.com/2018/12/18/more-than-mississippi-bridges-remain-closed/. (Accessed October 23, 2019.)

Wacker, J.P.; Crawford, D.M. 2003. Extending service life of timber bridges. In: 19th US-Japan bridge engineering workshop, UJNR panel on wind and seismic effects, Tsukuba, Japan.

Wacker, J.P.; Brashaw, B.K.; Jalinoos, F. 2015. A field assessment of timber highway bridge durability in the United States. In: Proceedings of the 2015 structures congress. April 2015, Portland, Oregon.